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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/579,542	05/26/2000	Cheng Chung Lin	TSMC2000-079	7369

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EXAMINER

VINH, LAN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 06/11/2003

16

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/579,542

Applicant(s)

LIN ET AL.

Examiner

Lan Vinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 May 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 14-20 is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Continued Prosecution Application

1. The request filed on 5/5/2003 for a Request for Continued Examination (RCE) under 37 CFR 1.114 based on parent Application No. 09/579542 is acceptable and a RCE has been established. An action on the RCE follows.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-8 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites the limitation of "with no intervening steps". There is no positive support for this limitation in the specification. Claims 2-8 also contain subject matter which was not described in the specification because they depend on claim 1.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-2 are rejected under 35 U.S.C. 102(e) as being anticipated by Narwankar et al (US 6,200,911)

Narwanka discloses a method for modifying the profile of narrow, high aspect ratio gaps on a semiconductor substrate. This method comprises the steps of:

depositing a first layer of USG (undoped silicon glass) by HDP-CVD at a RF source power applied to the top coil of the plasma chamber of 900 W (col 13, line 65-col 14, line 4; abstract), which reads on depositing a first layer of low k dielectric constant material by means of plasma enhanced vapor deposition at a first level of power applied to only the plasma

depositing the majority of the USG layer during the main deposition step by HDP-CVD at a RF source power applied to the top coil of 1300 W (col 14, lines 11-29),), which reads on with no intervening step, depositing a second layer of low k dielectric constant material by means of plasma enhanced vapor deposition at a second level power that is higher than first power level applied to only the plasma

Narwanka also discloses depositing the USG to a desired thickness and in fig. 8B, the two depositing steps 818, 820 can be repeated in the flow chart (col 14, lines 28-29), which reads on repeating the two depositing steps until the predetermined thickness is reached.

The limitation of claim 2 has been discussed above.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Narwanka et al (US 6,200,911) in view of Gardner et al (US 6,140,688)

Narwanka method as modified by has been described above in paragraph 5. Unlike the instant claimed inventions as per claims 3-5, Narwanka does not specifically disclose the claimed thickness of the low dielectric material layer.

However, Gardner in a method of depositing multi-layer dielectric layers, teaches that thickness of dielectric layer is a variable, if desired the thickness is modified to achieve a certain performance level (col 3, lines 4-6)

Hence, one skilled in the art would have found it obvious to vary the USG layer thickness of Narwanka in view of Garner teaching by conducting routine experimentation to achieve specific thickness of USG layer for the purpose of obtaining the best deposition rate.

8. Claims 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Narwanka et al (US 6,200,911) in view of Moghadam et al (US 6,413,583)

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Narwanka method has been described above in paragraph 5. Unlike the instant claimed inventions as per claims 6-7, Narwanka does not specifically disclose that the first power level is less than about 70 W/the second power is between about 70-200 W

However, Moghadam discloses a method for depositing low dielectric material comprises the step of applying RF power to the plasma in the range of 20 W to 100 W (overlaps the claimed range of 70 -200 W/less than 70 W) (col 8, lines 19-22)

Hence, one skilled in the art would have found it obvious to modify Narwanka by using a low power level as per Moghadam because Moghadam states that low dielectric material are most preferably produced using low levels of RF power (col 8, lines 15-20)

9. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Narwanka et al (US 6,200,911) in view of Huang et al (US 6,541,369)

Narwanka method has been described above in paragraph 5. Unlike the instant claimed inventions as per claim 8, Narwanka does not specifically disclose that the low dielectric constant material has a flat band voltage that is less than -3 V.

However, Huang, in a method of reducing trapped charges in semiconductor device, teaches that the flat band voltage of a semiconductor device having a low dielectric constant material has been reduced to -15V (col 6, lines 1-5)

Hence, one skilled in the art would have found it obvious to modify Narwanka by using a low k dielectric material has a flat band that is less than -3V in view of Huang teaching because according to Huang, a typical and acceptable value for flat band voltage is -15 V (col 2, lines 35-37)

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10. Claims 9-13 are rejected under Moghadam et al (US 6,413,583) in view of Murugesh et al (US 6,228,781)

Moghadam discloses a method for depositing a low dielectric constant film. This method comprises the steps of:

depositing a layer of low k oxidized organosilane/ black diamond (see prior art of record for evidence of this basis) by plasma enhanced chemical vapor deposition (PECVD) using a gaseous mixture of methylsilane, nitrous oxide and helium at low level of RF power at 10 W to form a layer having a thickness (col 13, lines 37-49; col 14, lines 10-40), which reads on depositing a low power level of black diamond through PECVD from a gaseous mixture of methyl silane and nitrous oxide enhanced by a plasma helium at a power level that is less than about 70 W to form a layer having a thickness

depositing a layer of low k oxidized organosilane/ black diamond by plasma enhanced chemical vapor deposition (PECVD) using a gaseous mixture of methylsilane, nitrous oxide, oxygen and helium at a level of RF power at 20-200 W (col 8, lines 17-20), which reads on depositing a high power level of black diamond through PECVD from a gaseous mixture of methylsilane, nitrous oxide, oxygen enhanced by a plasma helium at a power level between about 70 W-200 W to form a layer having a thickness

Moghadam does not disclose repeating the steps of depositing the low dielectric constant material for 10 seconds to reach a specific thickness of the low dielectric

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constant material layers although Moghadam discloses depositing the oxidized organosilane layer at about 2000 Angstroms per minute (col 14, lines 53-54)

However, Murugesh discloses a method for depositing FSG (low k material) layer comprises the step of continuously depositing FSG layer at different power level (low and high) in a cycle (10-60 seconds) until the FSG layers reach a desired thickness (col 13, lines 36-38). Murugesh' s teaching reads on repeating the steps of depositing the low dielectric constant material at low and higher power level for 10 seconds to reach a specific thickness.

Hence, one skilled in the art would have found it obvious to modify Moghadam's method by adding the step of depositing the low dielectric constant material layer at low and higher power level until reaching a desired thickness as per Murugesh because Murugesh teaches that the cycle of deposition until FSG layer/low k material having a desired thickness resulting in a film/layer having a low dielectric constant which has a good gap filling characteristic and stability (col 13, lines 38-40)

Regarding claims 11, 12, Moghadam discloses flowing 5-500 sccm of methylsilane, 5-2000 sccm of nitrous oxide, 200-2000 sccm of helium, (col 14, lines 20-25) and 2000-6000 sccm of oxygen, which overlaps the claimed ranges.

The limitation of claim 13 has been discussed above in paragraph 9.

Allowable Subject Matter

11. Claims 14-20 are allowed.

The following is an examiner's statement of reasons for allowance:

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Regarding claim 14, the cited prior art of record fails to disclose the step of depositing onto the low power layer of black diamond a high power layer of black diamond. The closest prior art of Cheung et al (US 6,287,990) discloses depositing a high power FSG layer 510 under the low power layer of oxidized organosilane/black diamond 514 (fig. 7)

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Li et al (US 6,168,726) discloses that oxidized organosilane is a low k dielectric with a trade name of black diamond (col 3, lines 46-53)

Response to Arguments

13. Applicant's arguments with respect to claims 1-13 have been considered but are moot in view of the new ground(s) of rejection.

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Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 703 305-6302.

The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 703 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and 703 872-9311 for After Final communications.



LV
June 8, 2003